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TESTING THE EFFICIENT MARKET HYPOTHESIS ON WEAK AND SEMI-STRONG FORM IN THE INDONESIAN STOCK MARKET

Gita Denaya Rizkianto and Budhi Arta Surya
School of Business and Management
Institut Teknologi Bandung, Indonesia
gita.Denaya@sbm-itb.ac.id

Abstract- The author tested the efficient market hypothesis on the Indonesian stock market by employing the serial correlation test to test the efficient market hypothesis on weak form level and the Multifactor Arbitrage Pricing Theory (Multifactor APT) to test the efficient market hypothesis on semi-strong form level. For the test on the semi-strong form, the author chose 8 stocks with the highest market capitalization from 8 different sectors of the LQ45 index as the dependent variables and the JCI (Jakarta Composite Index), oil price, inflation rate, and the foreign exchange rate as the independent variables. The author has 2 purposes in this final project. The first purpose is to test whether the Indonesian stock market is efficient on both weak form level of efficiency and semi-strong form level of efficiency. The second purpose is to give recommendation to investors in analyzing the Indonesian stock market. The results of this final project show that the Indonesian stock market is not weak form efficient and it is not semi-strong form efficient. This means that investors can gain abnormal returns by doing technical analysis on the historical movements and fundamental analysis. Although individually the JCI, oil price, inflation rate, and foreign exchange rate have low predictive power, they collectively possess predictive power over the stock return in the Indonesian stock market.

Key words: Efficient market hypothesis, weak form, semi-strong form, predictive power

Introduction

In the capital market, the desirability of a security is determined by its expected future cash flow. As a commodity, financial securities in the capital market follow the same principle as any commodity in any other market. This means that the price of a financial security is determined by its level of demand and supply, which in turn is highly influenced by the relevant information of that particular security that might affect the profitability of owning the security. As expected return of a security change, so will the number of investors who want to buy and sell it. If new information suggests that owning the security of a particular company will be very profitable, those who already own the security will be discourage to sell it while those who do not own the security will be encouraged to buy it and thus the balance of supply and demand for that security will change and the result is an increase in the price of the security. On the other hand, the exact opposite will occur if new information suggests that owning the security of will result in a loss, that is, as people who already own the security will be encouraged to sell it while those who do not own that security will be discouraged to buy it and like before the balance of supply and demand for the security will change and instead of a price increase, it is a price drop. For instance, if a company declares that they are going bankrupt, the desirability of its stocks and bonds will fall, as investors believe that the expected profitability of owning the company's stocks and bonds will be lowered and thus its supply will increase while its demand will decrease, which ultimately will make the

price drops significantly. On the other hand, if a company declares that its profit exceeds its projected amount by 3 folds, the desirability of its stocks and bonds will rise, as investors believe that the expected profitability of owning the company's stocks and bonds will be much higher and thus its supply will decrease while its demand will increase, which ultimately will make the price rise significantly.

The previous paragraph describes the strong relationship between security prices and information. This suggest that given perfect market conditions (market condition in which all investors have access to all information and all investors have the same opinion on the effects of information on security prices), any relevant information on a security that are presently available will move its price to a level in which it represents all available information. A market in which security prices fully represents all available information is called an efficient market and this theory was developed by Eugene Fama. In an efficient market, an investor cannot make profit based on current information, as they are already represented in the current price of the security and thus the only way an investor can make informational based profit is by possessing the knowledge of future information. Unfortunately, the nature of the future is inherently unpredictable and thus no one can now with 100% certainty what will happen in the future. Therefore, in an efficient market, an investor generates profit from a security not because they know better than the market but because they are willing to bear risks. This theory was so influential to finance, that it is still a debate among academics and practitioners alike until today. The fact that Eugene Fama has won a Nobel Memorial Prize in Economic sciences and considered to be the father of modern finance is a testament to the influence of the theory that he had developed.

There is an abundance of research on the efficient market hypothesis in the Indonesian stock market. For example, Utami in her "Efficient Market Hypothesis: Evidence from the Indonesian stock market" employed the Ljung-Box Q-test to test the correlation between stock return of one period and the one from the previous period. Her research shows that correlation between stock return of one period and the one from the previous period do exist and as such, she concluded that the Indonesian stock market is not weak form efficient, as it can be predicted by the historical return. In this final project, the author employed a different approach on testing the efficient market hypothesis in the Indonesian stock market. In addition to the serial correlation test to test to check the randomness of the monthly return on the JCI (Jakarta Composite Index), the author also tests the efficient market hypothesis on semi-strong form level by employing the Multifactor Arbitrage Pricing theory using panel data analysis.

Literature Review

Capital Market

The capital market deals with both fixed-income securities such as bonds and variable-income securities such as stocks and derivatives. The capital market does not contribute directly to the real economic output. That being said, it provides an incredible ease in the transaction of claims to real asset in the economy. Without the capital market the transaction of these claims on real assets would be nothing short of chaotic and complicated. The capital market provides a medium to which trades of claims real assets can be done efficiently.

Common Stocks

Unlike fixed-income securities such as bond, an equity security is a variable-income security and hence owning it bears more risk than owning a fixed-income security in the capital market. This is due to the fact that the issuer is not obligated to make payments to the stockholder while the payment for bondholder is a must. To put it simply, when a company is experiencing high profit the stockholder will receive a high payment and when the company is experiencing a loss, not only will the stock holder receive no payment but the value of their stock will fall as well, on the other hand, the company's bondholder will received similar payment regardless of how the company is performing.

LQ45

The LQ45 index consists of the 45 most liquid stocks in the Indonesian Stock exchange. The liquidity of these companies changes over time and as such, the component of the LQ45 index is changed from time to time to accommodate to it. The stocks listed in the LQ45 index is considered to be the collection of the best stocks in the Indonesian stock market and it comprise of stocks from various sector such as agriculture, services, consumer goods, industrial, finance etc. Because the stocks listed on the LQ45 index is considered to be the best, the author opted 8 stocks from 8 different sectors of the LQ45 index to be the dependent variables. These stocks are AALI, ASII, BBCA, ITMG, UNVR, SMGR, BSDE, and UNTR.

Macroeconomic Factors

Macroeconomic factors are factors that affect the real sector on the economy. All macroeconomic factors are systematic, meaning that it cannot be avoided nor could it be mitigated. In the real sector, macroeconomic factors affect the output of the entire economy and as such, all corporations regardless of its performance and scale will inevitably be affected by it. In this final project, the author chooses 4 macroeconomic factors to be considered as the independent variables. These factors are the JCI, oil price, inflation and foreign exchange rate. The reason as to why firm specific factors are not considered is because of the fact that the LQ45 index consist of stocks from various companies. The variety of stocks will diversify away the firm specific factors and hence it is safe to assume that firm specific factors do not affect the LQ45.

The Efficient Market Hypothesis

The efficient market hypothesis asserts that all presently available information is already reflected in the price of a security. In an efficient market security is priced appropriately, which means that prices already represent all information, whether it is historical prices, publicly available information, or information that are not available to the public and can only be accessed by certain individuals. In such markets, investors can only generate profit by knowing information of future events and since it is impossible for any investors to gain information of future events, we can conclude that in an efficient market, investors generates profit by bearing the risk that future information may or may not increase the value of their investment.

The Joint Hypothesis Problem

The implication of the joint hypothesis problem is the fact that any test of market efficiency must be conducted jointly with a model of equilibrium (A model of equilibrium is essentially the model that describes the "appropriate" price in efficient markets). Therefore, if empirical result suggests some market inefficiency, one cannot determine whether it is because the market really is inefficient or simply because the model is a bad model and it is not an appropriate representation of the market. To truly accept or reject the efficient market hypothesis, it has to be tested jointly with a model of market equilibrium that represents the market perfectly. Unfortunately, it is very unlikely that a perfect model of market equilibrium will ever be formulated and hence we may never know whether or not the market truly is efficient.

The Lucky Event Issue

One can argue against the efficient market hypothesis by pointing out the fact that there are certain individuals that consistently beat the market. The truth, however, the existence of such individuals does not necessarily reject the efficient market hypothesis. This is because of the fact that by chance, there are going be people who are lucky enough to consistently beat the market. The implication of the lucky event issue is the fact that it makes test of weak form efficiency on a trading method questionable. This is because of the fact that if a trading method successfully beat the market return consistently, it may

be due to luck instead of the method actually beating the market return. The same applies to the strong form test of observing the mutual fund manager. If mutual fund managers beat the market, it is difficult to distinguish between their superior knowledge and their luck.

Serial Correlation Test

A lag 1 serial correlation or autocorrelation test is a test that checks the randomness of a data set. Serial correlation test is essentially a simple regression analysis of a data set with itself on different time periods. For instance, the lag 1 serial correlation test of monthly stock returns on 2013 is conducted by regression analysis of the return from January to November with the return from February to December of the same year. Conclusion on whether or not the data is random is done by conducting the T test. The null hypothesis in this T test is that the data is random and the alternative hypothesis is that the data is not random. The regression analysis for testing the lag 1 serial correlation is done by using the Microsoft Excel software.

Arbitrage Pricing Theory (APT)

The APT asserts that any mispricing on a security will be quickly spotted by individuals in the market that forces the security to restore its price equilibrium. For instance, if a security is underpriced, some market participants will spot this disequilibrium and bid its price up until the equilibrium is restored. On the other hand, if a security is overpriced, some market participant will spot this disequilibrium and take a short position on it and thus, it will drive its price down to restore the equilibrium.

Multifactor APT

The Multifactor APT is a model of market that attempts to define the appropriate price based on various systematic and unsystematic factors. In this final project, the author includes only systematic factors. These factors include 4 macroeconomic factors such as the JCI, oil price, inflation rate, and foreign exchange rate. The Multifactor APT model is presented below.

$$ri = \alpha i + \beta i1F1 + \beta i\ 2F2 \ldots\ldots\ldots \beta i\ nFn + ei$$

Equation 1 Multifactor APT

Panel Data

In this final project, the author assessed the Ross' multifactor model (Multifactor APT) using panel data analysis. Panel data analysis is conducted by using the Eviews software. Brooks in his second edition of "Introductory to Econometrics for Finance" page 487 explains panel data as such:

*"The situation often arises in financial modelling where we have data comprising both time series and cross-sectional elements, and such a dataset would be known as a panel of data or longitudinal data. A panel of data will embody information across both time and space. Importantly, a panel keeps the same individuals or objects (henceforth we will call these 'entities') and measures some quantity about them over time"*Basic concept of this approach is to use the price per earnings (P/E) ratios of similar business that listed on share exchange to generate the value of a firm. The formula is

The Ratio Likelihood Test

The ratio likelihood test is conducted to determine whether or not the pooled model is appropriate. The null hypothesis is that the pooled model is the appropriate model while the alternative hypothesis is that the pooled model is not the appropriate model. If the null hypothesis is accepted, it is not necessary to conduct the hausman test, as the appropriate model is already known.

The Hausman Test

If the result of the null hypothesis of the ratio likelihood test is rejected, the hausman test has to be conducted to test whether or not the random effects model is appropriate. The null hypothesis is that the random effects model is appropriate while the alternative hypothesis is that the random effects model is not appropriate. Under the alternative hypothesis, the fixed effects model is used, as it becomes the appropriate model.

Coefficient of Determination

The coefficient of determination or the r square is the measures how well the regression model fits with the predicted dependent variable as explained by the independent variable. The scale of the r square value ranges from 0 to 1. An r square value of 0 indicates that the model is not the appropriate model, as the model does not explain the variation in the dependent variable due to the independent variable. An r square value of 1 indicates that the model is the perfect model, as the model explains all the variation in the dependent variable due to the independent variable. In practice, an r square value of 0 and 1 is almost unheard of and it is effectively impossible to get such an extreme r square values. In this final project, the purpose of calculating the coefficient of determination is to observe the goodness of fit of the regression model.

T Test

To determine whether or not the independent variables have any predictive power on the dependent variables, the T test has to be conducted. The purpose of the T test is to determine whether or not the independent variables individually have any effect on the dependent variables. In this final project, the null hypothesis suggests that JCI, oil price, inflation, and foreign exchange rate individually possess predictive power on the return of the Indonesian stock market while the alternative hypothesis suggests that JCI, oil price, inflation, and foreign exchange rate individually possess no predictive power on the return of the Indonesian stock market. In this final project, the purpose of the T test is to see which of the independent variables affect the dependent variables and which of those that does not. The T test is tested using the Eviews software.

F Test

To determine whether or not the independent variables have any predictive power on the dependent variables, the F test has to be conducted. The purpose of the F test is to determine whether or not the independent variables collectively have any effect on the dependent variables. In this final project, the null hypothesis suggests that JCI, oil price, inflation, and foreign exchange rate collectively possess predictive power on the return of the Indonesian stock market while the alternative hypothesis suggests that JCI, oil price, inflation, and foreign exchange rate collectively possess no predictive power on the return of the Indonesian stock market. Acceptance of the null hypothesis suggests that the market is not semi-strong form efficient while rejection of the null hypothesis suggests that the market is semi-strong form efficient. The F test is tested using the Eviews software.

Methodology

There are 6 steps in the formation of this final project. These 6 steps are hypothesis, literature review, data collection, data analysis, hypothesis testing, and conclusion. These steps are better explained by the following figure.

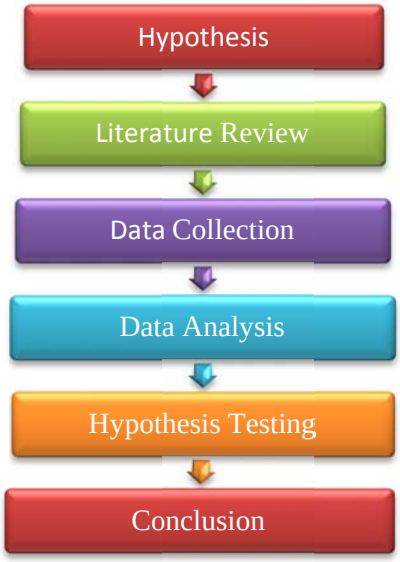

Figure 1 Methodology

Hypothesis

Hypothesis 1:

HoR: The return of JCI is random and thus the market is weak form efficient.

H1R: The return of JCI is not random and thus the market is not weak form efficient.

Hypothesis 2:

HoM: JCI, oil price, inflation, and foreign exchange rate effects the return of the 8 stocks and thus the market is semi-strong form efficient.

H1M: JCI, oil price, inflation, and foreign exchange rate do not affect the return of the 8 stocks and thus

Hypothesis Testing

To test the weak form efficient market hypothesis, the author employs the serial correlation test. To test the semi-strong form efficient market hypothesis, the author employs the Multifactor APT. The serial correlation test is conducted by using the Microsoft Excel software while the Multifactor APT test is conducted by using the Eviews software.

Data Analysis

Serial Correlation Test

The serial correlation test is conducted by using the Excle software and the result is presented below.

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.012409	0.005908	2.100125	0.03701
Serial correl	0.166083	0.068023	2.441563	0.01552

Figure 2

From the figure above, the p-value of the t test is 0.01552 which is higher than the α (5%). This indicates that there is no serial correlation in the lag1 monthly return of the JCI from 2009 to 2013. Since there is no serial correlation, we can conclude that the Indonesian stock market is random and thus weak form efficient

Multifactor APT

Since the Multifactor APT is essentially a multiple regression model, the statistical tool that is used to analyze the data is that of the multiple regression analysis. The multiple regression analysis is conducted in order to determine whether or not the independent variables have any effect on the dependent variable. The formula of the regression analysis is shown below.

$$ri = \alpha i + \beta 1F1 + \beta 2F2 + \beta 3F3 + \beta 4F4 + ei$$

Equation 5 Multifactor APT for the test of efficient market hypothesis

Test of Multifactor Model

To test whether or not the Indonesian stock market is semi-strong form efficient, the author employed the multifactor APT model and included the JCI, oil price, inflation, and foreign exchange rate as the 4 macroeconomic factors. The test is done by employing the panel data analysis. To analyze the data, the author used the Eviews (Econometric views) software.

Ratio Likelihood Test

Before starting the analysis, a ratio likelihood test is conducted to know whether or not pool model is appropriate. The null hypothesis of the ratio likelihood test is that the pool model is appropriate. The result of the cross-section F test is 0.5387 and the cross-section Chi-square is 0.3408, which means that the null hypothesis is accepted, as the value is larger than the alpha (5%) and thus the pool model is the appropriate model for the panel data analysis. The Eviews calculation result is shown in the table below.

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.874311	(7,28)	0.5387
Cross-section Chi-square	7.907377	7	0.3408

Figure 3. Ratio Likelihood Test

Since the ratio likelihood test suggests that the pooled model is the appropriate model, it becomes unnecessary to do the hausman test. If the null hypothesis is rejected, the next step that has to be taken is to do the hausman test to determine whether the random effects model is the appropriate model. If the null hypothesis of the hausman test is accepted, the random effects model is accepted but if the null hypothesis is rejected, the fixed effects model is the most appropriate model. In this final project, the ratio likelihood test shows that the pool model is the most appropriate model.

Pool Model Analysis

From the ratio likelihood test, the result shows that the value of the cross-section F and the cross-section Chi-square is 0.5387 and 0.3408 respectively. The result of both the cross-section F and the cross-section Chi-square is above the α (5%) and as such the null hypothesis of the ratios likelihood test is accepted. Therefore, the pool model is the most appropriate model.

The pool model analysis result using the Eviews software is presented in the figure below.

Dependent Variable: RETURN
Method: Panel Least Squares
Date: 03/02/14 Time: 09:58
Sample: 2009 2013
Periods included: 5
Cross-sections included: 8
Total panel (balanced) observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.013768	0.021726	0.633707	0.5304
JCI	1.314307	1.104379	1.190087	0.2420
OIL	1.110705	0.580011	1.914972	0.0637
INFLATION	-6.806632	7.744029	-0.878952	0.3854
FOREX	1.542317	2.191792	0.703678	0.4863

R-squared	0.555376	Mean dependent var	0.030293
Adjusted R-squared	0.504562	S.D. dependent var	0.048426
S.E. of regression	0.034086	Akaike info criterion	-3.803400
Sum squared resid	0.040665	Schwarz criterion	-3.592291
Log likelihood	81.06801	Hannan-Quinn criter.	-3.727070
F-statistic	10.92954	Durbin-Watson stat	1.387319
Prob(F-statistic)	0.000007		

Figure 4 Pool Model Analysis

The value of the R-squared (coefficient of determination) of the pool model is around 55%, indicating that 55% of the stock return is explained by the JCI, oil price, inflation, and foreign exchange rate while the other 45% is explained by other factors. An R-squared value of around 55% indicates that the model is a good fit. The T-test of the pool model analysis suggests that individually, the 4 macroeconomic factors do not have any significant effect on the 8 stocks, as none of the p-value of the t test is less than the α (5%). The macroeconomic factor that has the highest predictive power in descending order is oil price, JCI, inflation rate, and foreign exchange rate. The p-value of oil price, JCI, inflation rate, and foreign exchange rate is 0.0637, 0.2420, 0.3854, and 0.4863 respectively. As such, the entire null hypothesis of the t test is rejected and it is safe to conclude that individually, the JCI, oil price, inflation rate, and foreign exchange rate does not possess predictive power on the return of stock in the Indonesian stock market.

The F-test of the pool model analysis indicates a p-value of 0.000007. This means that the null hypothesis (HoM) is rejected and thus the Indonesian stock market is not semi-strong form efficient, as it can be predicted by the JCI, oil price, inflation, and foreign exchange rate.The figure below shows the graph of the actual value, the fitted value (value of the regression), and the residuals.

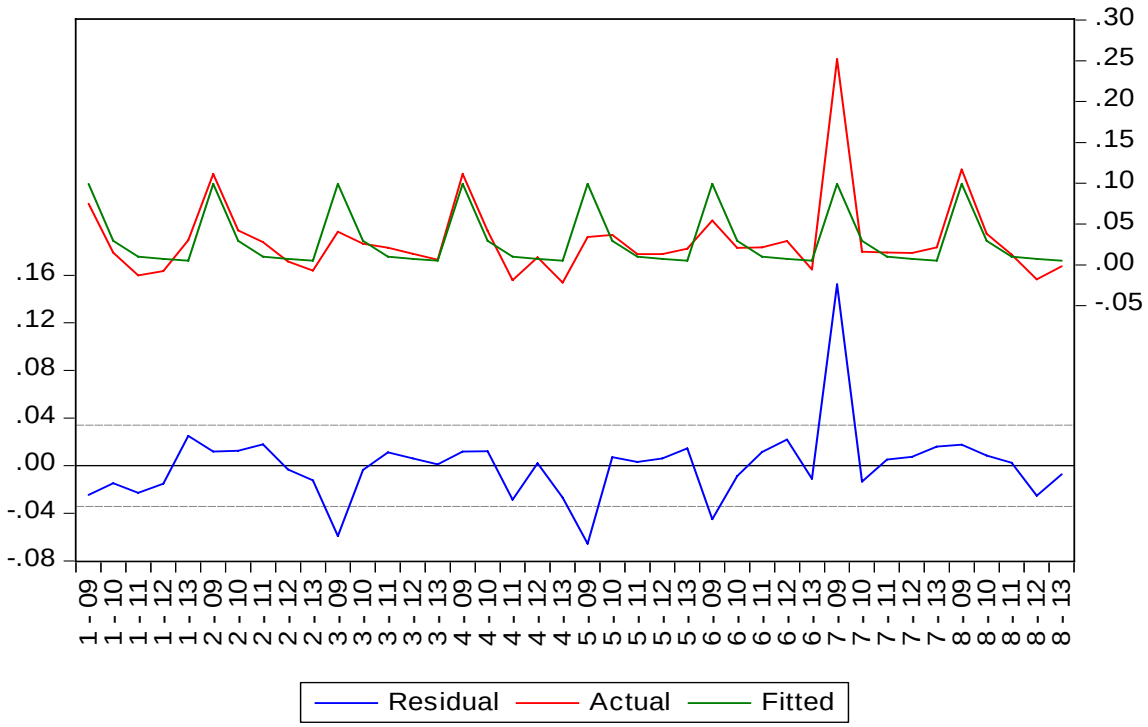

Figure 5

The purpose of this figure is to deliver a graphical representation of how well does the model stand up to the actual value. The red line represents the actual value of the 8 stocks and the green line represents the regression. The blue line represents the residual, that is, the deviation of the actual value from the regression. From figure 4, it is evident that on 2009 there is a spike in the actual value of the stock (the red line) on 5 out of 8 stocks. The stocks that saw a spike on its monthly return in 2009 are AALI, ASII, ITMG, BSDE, and UNTR.

One might argue that the spike is due to firm specific factors and while that might be true, the fact that it all occurred in 2009 suggest that it may be due to systematic factors. The most powerful candidate for the reason to this occurrence is the Eurozone crisis. As the European market become less desirable, investors starts to relocate their money out of European market and it into other countries including Indonesia. Furthermore, in 2008 the United States of America experienced the worst financial crisis since the great depression of 1929 and as such, in 2009 the US becomes a less desirable alternative for investors to relocate their money from European countries. Thus, investors turn to Asian capital markets including Indonesia to invest their capital and hence the spike in monthly return in 2009 for AALI, ASII, ITMG, BSDE, and UNTR.

Conclusions

The author opted to test the efficient market hypothesis for both weak form level and semi-strong form level. The weak form level of market efficiency is tested by testing the randomness of return in the Indonesian stock market and the semi-strong form level of market efficiency is tested by testing the predictability of stock return based on macroeconomic factors. The necessary theoretical foundation and the statistical tools used in this final project to analyze the data are collected from various literature sources while the data on stock and the macroeconomic factors are gathered from various internet sources. The test of weak form level of market efficiency is conducted by employing serial correlation test and it is essentially used to test the randomness in the return of the JCI in this final project. The results of the serial correlation tests suggests that the annual monthly return on the JCI is not random

and hence, does not satisfy the random walk hypothesis that stock returns in the Indonesian stock market is not predicted by the historical data. This is supportive evidence that the Indonesian stock market is not weak form efficient. The implication of this result is the fact that technical analysis may be used to gain abnormal returns in the Indonesian stock market.

In this final project, the author concluded that the Indonesian stock market is not weak form efficient. The next step in test of market efficiency after conducting the weak form test is to test whether or not it is semi-strong form efficient. To test this hypothesis, Ross's multifactor model is employed and it is analyzed using panel data. The author chose 8 stocks from 8 different sectors listed on the LQ45 index with the highest market capitalization as a representation of the Indonesian stock market and the macroeconomic factors that are included in this final project are JCI, oil, inflation, and foreign exchange rate. The result suggests that stock returns can be predicted by the 4 macroeconomic factors and hence, it is not semi-strong form efficient. The implication of the result is the fact that fundamental analysis can be used to gain abnormal returns in the Indonesian stock market. The results of this final project suggest that the Indonesian stock market is not weak form efficient and it is not semi-strong form efficient. Does this mean that the efficient market hypothesis is rejected? The answer is no, non randomness in return does not imply inefficiency even though it is a supportive evidence. On the semi-strong form, the joint hypothesis problem suggests that the abnormality may be due to the fact that the model employed is imperfect and it is more likely that the market model used in the semi-strong form test is imperfect rather than the market being inefficient. The multifactor model used in this research includes only 4 macroeconomic factors while there are obviously a lot of other macroeconomic and firm specific factors that influence stock returns.

Recommendations

In this section, the author presents the recommendation in how to predict the value of the stock in the Indonesian stock market. The purpose of this recommendation is to help investors who want to predict the return on stock in the Indonesian stock market. By doing so, the author hopes that investors in the stock market can make better decision when it comes to investing into the Indonesian stock market. The author recommends that investors should use historical returns of the stock to gain abnormal profits and also consider the JCI, oil, inflation, and foreign exchange rate as macroeconomic factors that should be taken into serious consideration. The recommendations are listed below.

- This final project shows that historical returns on the JCI are in fact not random in nature. Therefore, investors should make technical analysis about stock return in the Indonesian stock market.
- This final project shows that the JCI, oil, inflation, and foreign exchange rate possess predictive power on the return of stocks in the Indonesian stock market. Therefore, investors should focus on making fundamental analysis using the Multifactor model to predict stock returns using the 4 macroeconomic factors as the independent variable.

This final project shows that the Indonesian stock market is in fact not weak form efficient and it is not semi-strong form efficient. As such, Investors should do technical analysis and fundamental analysis to gain higher profits.

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